

Miscellaneous OBSERVATIONS,

Together with a COLLECTION of

EXPERIMENTS

O N

ELECTRICITY.

WITH THE

MANNER of PERFORMING them.

Designed to Explain the NATURE and CAUSE
of the most remarkable *Phænomena* thereof:

WITH

SOME REMARKS on a Pamphlet, intituled,
*A Sequel to the Experiments and Observations
tending to illustrate the Nature and Properties
of Electricity.*

To which is annexed,

A LETTER, written by the Author to the *Academy of Sciences* at *Bordeaux*, relative to the
Similarity of *Electricity* to *Lightening* and
Thunder.

By B. RACKSTROW.

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P R E F A C E.

THE reason that induc'd me to trouble the town with my thoughts upon so intricate a subject, was, my not being proof against flattery; which is a misfortune attending some others, as well as myself: and, as I shew'd the experiments in public, I took pains to consider of a plausible solution of each; and several gentlemen of distinction and capacity seeming pleased with the manner of my accounting for some of them, advised me to make a syllabus of the experiments which I exhibited, and write my sentiments upon them: and observing two sets of gentlemen of different opinions; the one, that would have all the Electricity to be attracted from the Floor, and none from the Air; the other set would allow none of the Electrical Fire to come from the Non-electric, I thought I could prove by experiments, that great part came from the Air, and that part is to be attracted from the Non-electric: so my thoughts led me to be as

a Mediator between these gentlemen, which I hope will give no offence: besides, it might be politic in me to be between; for I was told of an old Latin phrase, which, being Englished, implies, that the Midway is safest; and possibly one side may be more in the wrong than I.

I have had great encouragement since I began to shew the Electrical Experiments. Our gallant and illustrious Prince the Duke of Cumberland has honour'd me several times; and the last time I was farther honour'd by him, in bringing with him the Princesses Amelia and Hesse. I have had the greatest part of the Nobility of this Kingdom, Ambassadors, and principal Foreigners. I have been very much oblig'd by the gentlemen of the Royal Society, in doing me the honour of seeing my performances; but more especially those Experiments which I found out myself; but particularly by their worthy President, at several times, who was always so kind as to bring company with him, among whom were some of great distinction; I say, the encouragement I met with, and some gentlemen telling me I should be much to blame, if I did not write something in the manner I have attempted in this pamphlet: but I fear it has made me act as the Crow in the Fable, when persuaded to sing.

Thus

Thus losing a good deal of time, and knowing myself not qualified for an Author, I am almost satisfied, that, instead of a Philosopher, I am publishing myself to be of the family of the Wrongheads; and while I was writing this book, could have made the resemblance of several Right-Heads, and by that means would have put money in my pocket.

I had a great mind to have ask'd the Duke of Cumberland the favour of his sitting to me for his Bust. Numbers of all distinctions would have been glad to have a Bust of the Duke in the manner I make them from the life: there they would see a perfect Likeness; it being the surest and truest way of preserving one. This would have been of the greatest honour and service to me imaginable.

But, methinks, I hear one say, What is this Fellow at? Is this a Preface? No! 'tis an Advertisement! He is puffing about his Company; and tells us of his Business, instead of saying something of his Book. I own I am not used to write: read the Book; and if it has not a much better reception from the public than I expect, I will sincerely promise never to scribble again.

I wrote

I wrote a great part of this treatise two years ago; but now observing that those gentlemen who contradicted me (when I asserted the Electricity to pass through the Pores of bodies) and at that time would have it to be only as a Capsula to the Body Electrified, are now not only come into my sentiments, but endeavour to make the world believe, that they have found out, by experiment, that it does pass through the Pores of all Bodies more or less; which is only proving what I did almost three years ago, by my experiment in vacuo; which I shew'd in public, and even to those very gentlemen I now speak of, and particularly in the Beautifying Experiment.

However superficially I have handled the foregoing subject, I hope it will be excused, when I assure my reader, the remaining pages are written with all the Care and Exactness that my Capacity would admit of.

 Miscellaneous OBSERVATIONS

O N

ELECTRICITY.

N UMBERS of learned men agree, that whatever *effluvia* the earth affords impregnate the air; and that these are kept asunder by pure *Æther*: but to speak as an operator in Electricity, those *effluvia*, becoming saturated with electrical fire, repel each other. Sir *Isaac Newton* observes, that the particles of vapours, exhalation and air, do stand at a distance from one another, and endeavour to recede as far from one another as the pressure of the incumbent Atmosphere will let them: for he conceives the confused mass, vapours, air, and exhalations, which we call the Atmosphere, to be nothing else but the particles of all sorts of bodies of which the earth consists, separated from one another, and kept at a distance by the said principle.

Philosophers both antient and modern mention the air's being made fluid by fire. Several ingenious

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nious gentlemen deny air to be a distinct Element, but assert it to be a mass of particles the most opposite in their natures to each other, becoming air only by acquiring Elasticity and Volatility from the attraction of some subtil substance, which I take to be the same as our electrical fire, that being endued with the properties of attraction, repulsion, and expansion: it is the most subtil and elastic of all bodies, and seems to pervade and expand itself throughout the Universe; it is the first moving Agent in matter, and that from whence the air derives its spring; it is equally fitted to nourish and destroy, and is every-where ready at hand to break forth into action, being always restless, and very rapid in its motion, penetrating in its nature, and extensive in its effects; which the many surprising experiments we daily make fully prove, as well as those amazing effects it has upon animal bodies. And if we do but consider the great discoveries and improvements made therein within these three years, we must expect, that, by a due application to these experiments, some things may turn out very beneficial to mankind, both as to mental improvement and corporeal benefit.

The circulation is increased by a person's standing only upon a cake of resin, and so electrified; and the effects are so moderate, that they only serve to cheer and raise the animal spirits; for when it acts the strongest, it will increase the number of pulses three or four in half a minute, and when weak, about two; and even that, as I apprehend, may prove of very great service; but what tends to the greatest good, are the shocks given moderately, and with some judgment; and I am well assured, that it will remove many obstructions, and be

be of great use in paralytic cases ; it helps digestion, quickens the circulation of the blood, provokes urine, and causes a freer respiration and perspiration. All these I have often observed, and doubt not but that many other things beneficial to man may farther be discover'd ; such as may help in colic, iliac pains, spasms, convulsions, apoplexies, hysteric, rheumatic, and arthritic disorders, &c.

It is a pity, that some concerned in shewing these experiments, and writing upon them, should endeavour to intimidate people from going through them ; one by playing tricks to startle, and another by writing something terrible of death and destruction.

Since it is certain, from the similarity between gunpowder and thunder, &c. that several operations in Chemistry have an analogy to the *phænomena* of Electricity, if therefore I should attempt to explain the one by way of analysis from the other, in the following pages, however imperfectly, I hope the candid will indulge me a hearing.

Acid, saith *Homborg*, is never found alone, but always joined with sulphur, which determines it to this or that species producing different salts. Salts, according to Sir *Isaac Newton*, are dry earth and watry acid united by attraction, the acid rendering them soluble in water. He supposes the watry acid to flow round the terrestrial part as the ocean doth round the earth, being attracted thereby. Whatever attracts, and is attracted most strongly, is an acid in his sense ; and our electrical flame has both the smell and taste of an acid.

Salts are vulgarly reckoned the most active of the Chemical principles; but *Homburg* derives all their activity from the sulphur joined with them.

Whatever is ascribed to acid may be ascribed to fire, or *æther*. The particles of *æther* fly asunder with the greatest force; and, agreeable to Sir *Isaac Newton*'s doctrine, when united, they must attract each other with the greatest force; therefore they constitute the acid; for whatsoever strongly attracts, and is attracted, may be called an acid, as Sir *Isaac Newton* informs us in his tract *de acido*. Hence it should seem that the sulphur of *Homburg* and the acid of Sir *Isaac Newton* are at bottom one and the same thing; viz. pure *æther* or electrical fire.

Fire inclosed will attract fire. If we consider both natural and artificial glass, it is evident in the natural, such as the diamond, chrystal, *Scotch*, and *Brazil* pebble; all which have their attractive and repelling power upon friction. Glass artificial is a composition of lead and salt of the fixed kind, as salt-petre, such as will not evaporate with the most intense heat, sand or stone that will melt easily, which gives firmness and consistence to the glass. The stone made use of should be white and transparent, and strike fire with steel. Hence it plainly appears there is fire in the composition; and I can't help thinking but that it must imbibe a great deal in passing through that violent heat, as is evident in making red lead, in calcining antimony and salt of tartar, where a greater weight comes out than was put into the fire; wherefore the red lead, &c. should seem impregnated with fire,

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In spirits of nitre you will find the ignited bodies always in motion ; witness the fume when the stopple is pulled out : As for the flint made use of, it carries fire in it.

From lead are made various compositions, which contain both salt and sulphur. Hence may be gather'd that the principal composition of glass is fire.

It is certain that the *apparatus* is concerned in a more particular manner than the grinding of the air between the glass and hands, or cushion ; for if you lay a glass tube in the sun, it will acquire the power of attracting and repelling. There can be no grinding of the air in this experiment ; it is only the motion which the sun puts the glass into that makes it attract the lambent flame ; and those subtil particles which are in the glass, being put into motion by the very swift revolutions of the glass globe and attrition of the hands at the same time, we may as well suppose the air to be whirl'd round the sphere as water round the grind-stone ; and if we will allow, that fire inclosed, put into motion, will attract fire, it is but reasonable to think, that when the fiery particles which are in glass are excited by attrition, they will attract and set at liberty the æthereal fire from those gross and heterogeneous particles that clogg'd and restrain'd it from its natural activity ; but once let loose, it swiftly flies through all metals, vegetables, and animals that come into contact, and are suspended by silk lines, or stand upon such bodies as have a power of attracting and repelling, such as glass, amber, wax, resin, &c. when excited by friction, before it mixes with the universal æther ; and as it
passeth

passeth through the before-mentioned bodies, it has the power of attracting and repelling all light bodies, and of attracting fire out of the animal body ; and it is reasonable to think, that those bodies that are become electrified have the power of attracting the particles of *Æther*, as well as the excited globe ; and we observe accordingly, that the lambent flame flies through all these bodies almost instantaneously ; *viz.* the wires, gun-barrel, &c. and the particles of *æther*, having the power of attracting, bring along with them in their progression all light bodies ; but when those light bodies touch the body electrified, they become saturated and repell'd with force, by the fresh influx of *Æther*.

It is allowed, that bodies electrified form to themselves an Atmosphere, which corroborates what I have said ; for, suppose a copper globe electrified, it will attract in all directions the particles of *Æther* that are within a certain distance : all these particles have a tendency towards the centre of the copper globe, and in their progression bring along with them all such light bodies as they meet within their sphere of action, such as thistle-down, &c. ; but these light bodies no sooner touch the electrified copper globe than they become fill'd with *Æther*, and form an Atmosphere to themselves, whose centre of motion being different from that of the globe, and being the lighter bodies (and by force of the fresh quantity of electrical fire darting into the thistle-down, continually rushing from the excited glass globe), they are repell'd, and kept out of the sphere of action of the copper globe, or other bodies electrified, their pulses being in different directions ; but if we were not to send a fresh quantity of *Æther* they would not be repell'd, for the action would cease.

It

It is observ'd, that urine produceth no phosphorus till it be long expos'd to the air ; from all which we may conclude, that bodies attract and fix the light..

That light or fire which is attracted and fixed by the urine being expos'd to the air, must be what we call electrical fire, or pure Æther ; for both phosphorus and Electricity have the peculiar property of appearing much more luminous *in vacuo* than where the culinary fire can subsist.

Both new and old bays attract this fire ; and it has often been observed in a frosty night, that the bays shall look luminous, and at the approach of a finger to it that the electrical stroke shall be felt.

Fire or light mixeth with all bodies, even with water ; witness the flashing lights in the sea, whose waves seem frequently all on fire, as do those luminous exhalations from putrified waters called *ignes fatui*.

The experiment of the phial of water is an immediate and substantial proof of this ; and farther evinceſh what the bishop of *Cloyne* saith, that Æther, fire, or spirit, being attracted and clogg'd by heterogeneous particles, become less active ; and I have kept a phial of water almost ten hours, which I had electrified before it had lost its electricity.

And again, the heterogeneous particles cohering with those of æther become more active ; witness the water from the capillary syphon, which, from mere dropping, is forced to run a full stream when electrified.

This

This also proves the repelling force, by the fresh quantity of *Æther* rushing on; for it is to be observed that the Electricity swiftly passes away from the end of a small wire, in diverging rays representing a lambent flame, and so from the end of the small syphon the electrical flame works off, and swiftly moves the water along with it.

In Dr. *Desaguliers's* course of experimental philosophy, he asserts air to have the following properties, on which I have made the ensuing remarks; viz.

‘ That air is a fluid, consisting of parts that
 ‘ drive each other from their respective centres;
 ‘ because it has been found by experiments, that
 ‘ its density is equal to its compression; and Sir
 ‘ *Isaac Newton* has demonstrated such a fluid must
 ‘ consist of parts that have a centrifugal force.’

I imagine the air or atmosphere to be the *effluvia* of the earth saturated with electrical fire, which causes those *effluvia* to repel each other, and expand every way, and to be of such an elastic force as to cause their density to be equal to their compression.

‘ That air near the earth is in a compress’d
 ‘ state, by reason of the great weight of the air
 ‘ above it: the atmosphere is no higher sensibly
 ‘ than about 45 miles, as is shewn by considering
 ‘ how high the mercury must stand in the baro-
 ‘ meter at different heights above the surface of
 ‘ the earth.’

By

By this it appears to me, that the farthest that the *effluvia* of the earth are attracted from the surface thereof is not above 45 miles; and these *effluvia*, being acted upon by the electrical fire, are repell'd and kept at a distance every way from each other; and that it is these *effluvia* that press against all terrestrial bodies, which is what we call the pressure of the air or Atmosphere. For the electrical fire, or pure *Æther*, could not have that effect alone; the particles, being so very subtil, would pass through the pores of most bodies: and the reason that we have no pressure from that which is above 45 miles from the surface of the earth, is, that it is pure *Æther*, of so subtil a nature, as to pass through the pores of bodies, and not to press upon those bodies.

‘ The air always endeavours to continue of the same tenour: if it be condensed or rarefied in one place, when left to itself, it will return to its former density. Upon this principle are artificial fountains fill'd and play'd.’

Let us suppose air to be condensed in the barrel of a wind-gun; if then the *effluvia* of the earth, cohering with *Æther*, be what we call the air, and if to *Æther* air owes its spring, and if such *Æther* be of so very subtil a nature, why does it not pass through the pores of the barrel; and by that means the air that was condensed in the barrel lose its spring? I answer;

There being no more *Æther* than enough to saturate the *effluvia*, I believe it would not fly off from the *effluvia*; but if it were possible to set it at liberty

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in the *vacuum*, it would expand itself and *effluvia* to a surprising circumference.

In the experiment of a tight-blown bladder being put upon an air-pump under a receiver, and the air exhausted so as to take off the pressure of the air from the bladder, the *Æther* does not pass through the pores of the bladder, and leave the *effluvia* behind, but causes the *effluvia* to expand, and burst the bladder with a loud report. The same may be done with a square glass bottle. But when *Æther* is separated from all such heterogeneous particles as can restrain it, as we separate it when we shew the electrical experiments, the *Æther* passes through the pores of the bladder, as it does through the pores of all metals.

But the pressure of the Atmosphere (being of the same quality with that which is condensed in the gun-barrel or bladder) keeps up the equilibrium, as the air in the body enables us to bear the pressure of the Atmosphere, and has the power to repel or prevent the electrical fire or *Æther* passing through the pores of the barrel or bladder, and by that means preserves the spring to the air within of them.

Air is therefore a mass of various particles, abraded and sublimated from wet and dry bodies of all sorts, cohering with the particles of *Æther*. But *Æther* being separated from those heterogeneous particles becomes exceedingly more active. I have, by endeavouring to separate them, become so strongly electrified, that I have emitted fire that has been both sensibly felt and seen, without my standing upon any electrical bodies, but only upon the bare boards, and even without shoes.

The

The method I made use of to separate the electrical fire from the particles that clogg'd it will be described in the experiment of the Chair. But as to pure *Æther*, or electrical fire, the excited globe attracts the greater part, if not all, from the air. I need not except what is attracted from the non-electric by the *Apparatus* when electrified; the non-electric recovering its fresh supply from the air: for when we have an intense watry Atmosphere, and the pressure of air the least, we can get but very little Electricity; but in a fine clear day, when the pressure of the air is greatest, we get the greatest quantity of electrical fire.

Query. If this fire was attracted from the floor, as Mr. *Watson* supposes, why should we get the most Electricity when the pressure of the air is greatest, as it is in the finest days? One might naturally think that the great pressure would tend to keep it within the earth; and if it is attracted from the floor only, what need we mind the state of the air, or whether our supporters are non-electric or not?

It may be observed in the experiment of the Feather, that when the globe begins to turn to electrify, the plumes of the feather are first attracted downwards; which shews that the stand the Feather is placed upon, as it becomes electrified, has the power of attracting the particles of *Æther* that are in the air; which particles bring down the fibres of the Feather, as they are attracted towards the stand; so the Feather seems to shrink before it is electrified, as it does when a non-electric touches any part of the wire that is in contact with the Feather when electrified; but when the stand becomes saturated,

and forms an Atmosphere of electrical *effluvia* itself, those *effluvia*, by getting between all the small fibres of the Feather, cause them to expand, and their points to be kept at a distance as far as possible, as they do in all bodies that float in air.

Before I shew'd the electrical experiments in public, I set my machine, and the man that turn'd the wheel, upon resin, to collect much more of the Electricity, but found myself deceived: I therefore concluded immediately, that as one magnet would not attract another, but a piece of steel being within a proper distance of a loadstone, the attraction would be immediately perceivable, so two Electrified Bodies do not attract each other, but endeavour to recede from one another as far as they can. Therefore I was not surpris'd when I made these and some other reflections, that the machine, when set upon resin, and the men that work'd it, should lose the power of collecting the Electricity: for we may consider them as in air, so the gun-barrel, wires, &c. the same; the resin or silk not allowing the electrical fire to pass thro' them into the floor: but seeing that the man who holds his hands, and he that turns the wheel, and all the wood, and metallic part of the *Apparatus*, while on the floor, are non-electric; therefore they are ready to attract and convey the Electricity.

This pure Æther, Fire, or Light, the mighty Agent in the hands of our Great Creator, expands itself through the heavens, is always restless, and instantaneous in its motion; is absorbed by the earth in one part, and flies out at another; passes through and pervades the pores of all bodies; and when the glass globe is strongly excited by the attrition of the hands, and the air gather'd round
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the glass sphere, the æthereal fire therein is attracted, loosen'd, and separated thereby from the watry and earthy particles that clogg'd it, and passes off in a current from each hemisphere of the excited globe, through the man that holds his hands upon the globe, from one hemisphere; and through the gun-barrel, wires, &c. from the other; which being properly suspended by silk lines, clog and restrain the Electricity from its natural activity; which we are sensible of upon the approach of a finger: we may see the fire, and feel the stroke; but tho' it passes through the man that holds his hands upon the globe to excite it, as he stands upon the ground, he is neither sensible of it, nor those who attempt to touch him: but if he stands upon resin, he becomes strongly electrified; tho' if a non-electric takes hold of the man that stands upon the resin, and is electrified, he immediately loses his Electricity, it is attracted by the non-electric from him; which instantaneously passes through, and is absorbed by the earth.

While this is transacting on one side of the globe, let a non-electric take hold of the gun-barrel, or the wires that convey the Electricity, on the other side, and all on that side will lose the Electricity that instant, it passing through them that take hold into the floor. Now the Electricity being taken off on both sides, let a third person hold the wire of the phial of water against the globe, and it will electrify it. (All the while the globe must be kept in motion, and the man hold his hands upon it.)

I can no-ways conceive how the very thing that takes away the Electricity, should convey it to the globe to electrify water: I should rather think,
since

since the men and the *Apparatus*, viz. the wood and metallic part, are non-electric while standing upon the ground, that they would assist in attracting and letting loose the electrical fire from the air; one part of which immediately rushes through the man that holds his hands upon the globe into the floor; whilst the other part passes through the gun-barrel, wires, &c. but not so instantaneously; for which reason it assists us in shewing the experiments.

The gun-barrel, wires, &c. when electrified, have the power of attracting the æthereal particles that are in the air; those particles attracted are in most of them in different directions to those which came from the glass globe, and electrified the gun-barrel, &c. the continual efflux of electrical Æther from the excited glass globe, acting stronger than those particles that are in air, as it rushes through the electrified bodies, is that which makes it necessary for a non-electric to be held nigh the gold or silver Leaf, in its suspension, to take off the Electricity as fast as the upper plate electrifies it; it is this that keeps the æquilibrium; and the repulsion the Electricity meets with in the gun-barrel from those particles in the air, confines it longer to those bodies we call Electrified, than to those through which the current of Æther passes into the floor; the particles being in one direction makes the motion instantaneous. We first by motion set at liberty this electrical fire from the particles that clogg'd it, and afterwards strive to restrain it from its activity, that we may make use of it to shew these surprising experiments.

Mr. *Watson* (in p. 59. of his *Sequel to the Experiments*) in giving a solution of the suspension of the silver leaf, says,

‘ 1. That the blast of electrical *Æther* from the excited plate blows the silver towards the plate unexcited : this last, in its turn, by the blast of electrical *Æther* from the floor setting through it, drives the silver towards the plate electrified.’

As to the blast of electrical *Æther*, it would repel the silver, if it was not for the non-electric attracting the Electricity from the silver as fast as the excited plate electrifies it: I say it is as a canal of communication, which discharges the Electricity from the excited non-electric to the unexcited one. Let any one try this experiment, by holding the back of his hand under the silver, instead of the plate, and he will feel the Electricity blowing like a cold air against his hand (the feeling giving us no positive notice of any degree of fire below the natural heat of the body, or of any so great as to destroy the organs).

It appears by this, that the Electricity is passing through the non-electric into the floor ; and not that it comes from the floor, and so blows the silver towards the electrified plates.

When thistle or feather-down, &c. are attracted by a body electrified and repell’d, they never will touch an electrified body, till they have touch’d a non-electric, to which they communicate their Electricity, and so are made ready to be fresh attracted, but are not blown back again by the non-electric : for if a non-electric touches thistle-down, &c. after they have been repell’d, even at three feet distance from the electrified body, they will be attracted back again, though the person, as soon as he touches it, gets as far from it as he

he can; I rather take it that the plate electrified has the power of attracting the particles of Æther that are in the air; and that these particles, having the quality of attraction also, bring along with them thistle-down, or any light body; and that the Electricity which passes through the silver, and is felt on the back of the hand of the non-electric, is the Æther that would repel the silver, and not that which did attract it.

‘ 2. That we find from hence likewise, that the draught of electrical Æther from the floor is always in proportion to the quantity thrown by the globes over the gun-barrel.’

When we can collect the most Electricity by the excited globe, the most is attracted from the air by the body electrified as well as from the non-electric, and its action is greatest on a clear dry day, at which time the animal body seems to be possessed of more electrical fire, or at least is more active, and more chearful and enlivened; but contrariwise, on a dull day the spirits are heavy and oppress’d.

By the quantity thrown *over* the gun-barrel, I confess I no more understand him than I should if he had said thrown *under* the gun-barrel. I am pretty well assur’d; that he does not mean, that the Electricity is as a *capsula* to the gun-barrel; and if he did, he would be much in the wrong; for I can prove by experiments, that it passes through the pores of all bodies it electrifies.

‘ 3. He farther observes, that a Gentleman whose shoes were perfectly dry, and of consequence originally-electric, and who was employed
‘ to

‘ to hold the non-electric plate, through which
 ‘ the Æther was to come from the floor. This
 ‘ gentleman, he said, did not furnish a sufficient
 ‘ quantity (because of the driness of his shoes) to
 ‘ maintain the æquilibrium, and so the Silver was
 ‘ blown away.’

This gentleman, he supposes, acted the same as if he had stood upon a cake of Resin, the soles of his shoes being thick and dry; and some animal substances, when dry, will not let the Electricity pass through; whereas the truth of the matter seems plainly to be this; *viz.* that the person who holds the under plate standing upon the resin becomes electrified by the Electricity passing through the Leaf to him; and being fill’d, cannot take any more from the Leaf, and the silver becomes saturated and repell’d by the under plate as well as the upper one; so that when the Æther comes from him that holds the plate, the Leaf is blown away, instead of being kept in the state of suspension. But if the person employ’d to hold the under plate endeavours to catch the Leaf in the plate, he may; and then, if he holds the under plate about the same distance from the upper plate, as he did when the Leaf was suspended, and stand some little time in that posture, the Electricity, which the silver and person receiv’d, that held the under plate, from the excited upper one, beginning to pass off thro’ the emunctory pores into the Air, (for it can’t pass through the resin into the Floor) the Leaf will be fresh attracted, and again saturated and repell’d; and will act in this manner as long as you have a mind to try the experiment: therefore the Electricity that forces the Silver to the excited plate must come from the Air; it cannot come from the Floor, as not being able to pass through the Resin.

P. 60. Mr. *Watson* further says : ‘ But I am able
 ‘ to prove the Afflux experimentally, as well as the
 ‘ Efflux, in the following manner : When the Sil-
 ‘ ver lies still, though the motion of the globe is
 ‘ continued between the two plates, one suspended
 ‘ upon the gun-barrel, and the other placed upon
 ‘ an electrical cake, a person standing upon the floor,
 ‘ needs only bring a small glass Syphon in a vessel
 ‘ of water, and apply the long leg thereof near the
 ‘ plate placed upon the wax ; for upon this the
 ‘ Silver is immediately suspended, and the water,
 ‘ which before only dropped, now runs in a full
 ‘ stream, and appears luminous. Does not, in this
 ‘ case, the current of the Water point out the di-
 ‘ rection of the current of electrical Æther?’

I say it does ; and shews, that it takes the Elec-
 tricity from the plate, that was before electrified,
 and conveys it into the floor ; and not that it
 passes from the floor into the person that holds the
 water, and then through that into the plate, and
 so blows up the Leaf.

To corroborate this, try the following experi-
 ment. Let the upper suspended plate, which is
 about ten inches diameter, be electrified, and the
 under plate, about 18 inches diameter, be set
 upon a cake of Resin, at a proper distance from
 the upper one ; and let a person, standing upon
 the ground, place one finger upon the under plate,
 and the Silver will be suspended ; then try, by
 bringing a finger of your other hand very nigh
 the under plate, to see if it is electrified, and you
 will find it is not ; and this is the time at which
 he supposes the Electricity is blowing from the
 under plate to suspend the Leaf : but what electrical
 fire

fire it receives from the upper plate through the Silver will be instantaneously convey'd into the floor, the particles being in the same direction: now let the person take the finger off the under plate, and the Silver will be but a little while suspended, but begins to be attracted and repell'd; it is collecting the Electricity from the upper plate, and conveying it to the under one, and seems to grow weaker and weaker, and at last lies at rest upon the under plate; both the Silver and plate becoming saturated with Electricity, if you try with your finger you will find the plate is electrified; you may see the fire, and feel the stroke. Whilst the Leaf continues electrified, it has the power of repelling the particles of *Æther* that are attracted from the air, and which would disturb it if not electrified; but, upon the approach of the long leg of the Syphon, the water just at first is attracted in a full stream, tho' immediately after only it drops, and the Silver is only attracted and repell'd faintly; but, on the nigh approach of the Syphon, it will be suspended.

This is no more than as if a non-electrified person was to put his finger on the under plate, which would take off the Electricity. I agree, that bodies electrified will attract the Electricity from the non-electrified person, so as to meet in different directions; but when the Electrified body attracts the Electricity from the Non-electric, there is no medium between, no silver Leaf, Feather, or Thistle-down, &c. The greater body will attract to itself the lesser: there can be but little Electricity in the Silver; therefore it is attracted by the Non-electric; there is but little in the Feather, or Thistle-down, or such light bodies; therefore they are attracted by the Non-electric, and convey'd into the Floor.

A person highly electrified, standing upon Resin, no sooner lets one foot touch the floor, but all the Electricity is absorbed by it. And this is agreeable to what I have asserted, *viz.* that the electrical Æther is expanded throughout the whole mundane system.

P. 63, 64. he further adds: ‘ When the machine, &c. are placed upon Originally-Electrics, ‘ if a man, standing likewise upon Originally-Electrics touches the gun-barrel while the globes ‘ are in motion, he will receive a snap or two; ‘ after which, though the motion of the globes is ‘ continued, he will receive no more fire from the ‘ gun-barrel. While in this posture, if he touches ‘ the wood-work of the machine with one hand, ‘ and applies a finger of his other near the gun-barrel; at that instant he receives the electrical ‘ strokes: these continue as long as he touches the ‘ machine, but cease upon his removing his hand ‘ therefrom. Here we see a circulation of part ‘ of this man’s electrical fire, which operates in ‘ the following manner: First, the man, by applying one of his hands to the machine, becomes a ‘ part thereof; and by the motion of the globes, ‘ part of the electrical fire inherent in his body is ‘ driven upon the gun-barrel; but it is instantaneously restored to him again, upon his touching the gun-barrel with his other hand: thus he ‘ continues communicating the fire with one hand, ‘ and having it restored to him with the other ‘ as long as he pleases.’

The man, upon receiving the strokes from the gun-barrel, becomes saturated with Electricity; there can be no attraction between him and the gun-barrel, they both being electrified by the same power:

power : upon the man's touching the wood-work of the machine, he gets rid of his Electricity ; therefore is ready to receive a fresh quantity from the gun-barrel, which he again bestows upon the wood-work of the machine, and so on ; and if he was to wait a small space without touching the machine, the Electricity he had received would fly off into the Air, and he, upon approaching his finger to the gun-barrel, would receive a fresh supply.

There is no circulation of part of this man's fire in this experiment : a man saturated with Electricity can take no more, till he has got rid of that, or part of that, which he had received.

Two persons electrified by the same power have no more effect upon each other, than two that are not electrified. They are as two horses or men, &c. that pull from, or push equally against, each other ; neither overcoming, they produce no motion : but if two persons, standing upon two cakes of Resin, be placed so nigh, as that, when their arms are stretched out, they might touch, and each be electrified by a different globe, one of these globes would act stronger than the other ; and, consequently, one of the persons would be stronger electrified than the other, and, upon approach of their fingers to each other, the electrical stroke will be both felt and seen ; till he that is the least electrified receives as much Electricity from the other as to keep up the equilibrium between them ; which will be in two or three explosions, and then they can't have any effect upon each other.

Some other experiments, back'd by this, have made some (who think too lightly of the matter)
not

not only to imagine, but assert, that all the electrical fire comes from the body Electrified, and none from the Non-electric : that the electrical particles do not meet in different directions, but rush on in a current one way, that is, from the body Electrified to the Non-electric ; which is as much as to say, there is no attraction, and that there is only the repulsive force ; or if they allow of attraction, it must be the Non-electric that attracts the Electricity from the body Electrified ; and not, that the body Electrified has the power of attraction ; and then where is the repulsive force ? By this way of reasoning they destroy either the attractive or repulsive power.

It is a known principle in attraction, that the greater body will attract the less to itself ; that a person Electrified, and a Non-electrified one, have (for certain) the power of attracting the Electricity from each towards each other ; but the body electrified must have the power of attracting the strongest ; and where the attractive power ceases, the repulsive begins ; which must act stronger from the body Electrified than from the Non-electric : therefore some of its Electricity at that time darts into the Non-electric, as endeavouring to keep up the equilibrium ; a known principle of the Air, for which it is indebted to Æther : for Air, left to itself, will be always the same ; which enables bodies to bear the pressure of the Atmosphere.

By desire, I have here made some remarks upon such bodies as I found Electric, and such as I found Non-electric ; though, in a strict sense, there is no such thing as a Non-electric, all bodies being endued with more or less of Elelectrical fire.

Of

Of ELECTRICAL BODIES.

1. **T**HOSE bodies that repel the electrical fire, and will not suffer the Electricity to pass through them, and, when excited by friction, have the qualities of Attraction and Repulsion, such as Amber, Glass, Wax, Resin, Pitch, &c. may, for distinction-sake, be call'd Electrics *per se*.

2. Bees, Beetles, Moths, and Flies, both *Indian* and *English*, the Chrysalis's of Caterpillars that spin like the silk-worm, are electric when dry; and Land-Shells, Silk, Leather, Hair, Woolen, Tortoiseshell, Fat or Tallow, *Sperma Ceti*, and such sort of animal substances, though they have not the virtue of attracting and repelling, are term'd Electrical, because they will not suffer the Electricity to pass through them.

3. Brimstone, Cinnabar, Tutty, a faint Electric: Camphire and other Gums are Electric.

And I have observed, that the Fat of Animals, and the resinous Juices of Vegetables, are Electrical bodies, and both serve equally to the preservation of the individual from whence they proceed.

Of NON-ELECTRICS.

WHAT we call Non-electrics, are such bodies as serve for Conductors of Electricity; *viz.* all that will suffer the Electrical fire to pass through their pores. It was generally thought, that all animal substances, when dry, would not convey Electricity, wherefore they were term'd Electrics; but among the following are some animal substances, which, when dry, I have tried, and found conveyers; therefore they are Non-electric.

1. The Jaw of a Shark, Sea Unicorn's Horn, Sword of the Sword-fish, Joints of the Back-bone of a Whale, Horn of a Rhinoceros, Stag's Horn, Elephant's Tooth, human Skeleton, Bones in general.

2. Bones, Arteries, Veins, Muscles of a Boy preserved.

3. Skin, Bones, Muscles belonging to it, and Hoof of an Elk; but no great conveyer.

4. The Sea-Turtle, Pizzle of a Whale, and Sea-Shells in general, Crocodile, Flying Fish, and Old-Wife.

5. Skin of the scaly Lizard; but not a great conveyer.

6. Oils of Hartshorn and Vitriol.

7. All sorts of Waters.

8. Most kinds of Earth, and Stones, even the Loadstone.

9. All Animals alive or dead, if the fluids are in the body, are Non-electrics, being great conveyers of Electricity.

10. All Vegetables, while growing, are Non-electrics; most part when not growing.

11. Minerals, such as Alum, Vitriol, Salt-petre, and Antimony.

12. Metals in general.

1. We find, among the list of Electrics and Non-electrics, that the Chrysalis's of those Caterpillars that creep into the Earth, to change into the Aurelian State, when dry, are Non-electrics.

2. But the Chrysalis of that Caterpillar which spins like a silk-worm, is Electrical.

3. Sea Shells in general are Non-electric.

4. Land-Shells Electrical.

5. Oils made from the parts of Animals, or Vegetables, that are in themselves Electrics, will be

be Electrical; such as Train, Turpentine, and Linseed Oils.

6. But Oils made from Metals and Minerals, as Oil of Vitriol, or from parts of Animals that are Non-electrics, as Hartshorn-Oil, are Non-electrics.

This Æthereal or Electrical Fire I take to be the vivifying spirit that resides in Air, which, taken into the lungs of an animal, is separated from the heterogeneous particles, and those watry and earthy particles are again immediately repell'd out of the lungs; but the pure fire swiftly passes over the whole body, which, mixing with the blood, keeps it in due fluidity, and free from coagulation; for most fluids are both Retainers, for some time, and great Conveyers of Electricity; the Æther seeming to agree more with fluids than any thing else, and to stay longer with them. This keeps the fibres in due vibration, and the fluids in proper motion, actuating the whole mass; but changes, as heat and dryness, cold and moisture, &c. alter the Elasticity of the Air, keeping open and cleansing the most minute pores and passages of the body.

Without this fire in the Air, the culinary fire could not be kindled, nor life preserved. It has been found by experiment, that what is not good for one will not serve for the other; that Air, taken out of the lungs will neither feed life nor flame. As it is the great medium of Respiration, so it is of Digestion, Sanguification, Nutrition, Pulses of the Heart, and Muscular Motion; and I believe it to be what some call the Animal Spirits; as for other qualities of the Air, iron and copper are corroded, and gather rust in the Air, and all sorts of bodies are corrupted and dissolv'd.

By this is shewn an acid diffused throughout the Air ; and, as the Bishop of *Cloyne* observes, Air is as a general Agent, exerting its own, and calling forth the qualities or powers of all other bodies, by a division, comminution, and agitation of their particles, causing them to fly off, and become volatile. In animals living or dead, their fluids are as a vehicle to *Æther*. The animal, while alive, has Heat, and Heat ; according to the *Peripatetics*, will attract homogeneous things, and disperse heterogeneous, which keeps the body from corruption ; but when dead, and that Heat has left the body, the heterogeneous particles have power to act upon it ; there being no drug, salutary or poisonous, whose virtues are not breath'd into Air. Here we find the *Æther* cohering with heterogeneous particles on one hand, dividing, abrading, and attracting the volatile particles of all bodies, that are in the state of corruption, into Air, and there preserving those particles, as in a safe Repository, till a proper season to bestow them again in new generations. Acid volatile Salts, Earth, and Water, are nutriment to Vegetables, these to Animals ; and the volatile Salts of Animals, while in a state of putrefaction, fly off into Air again, mix with the Earth and Water ; which keeps up the round of putrefaction and generation.

Having given this account of the nature and properties of Air and *Æther* (wherein the expressions Electricity, Electrical Fire, and *Æthereal* Fire, are synonymous) and also of what substances I have found to be Electrics, and what Non-electrics, it now remains that I should verify the doctrine by experiments, and make some remarks thereon

thereon ; which is humbly offered in the manner following :

1. The late ingenious Mr. *Hauksby* was the first that made use of the glass globe, in what he called his Attrition-Engine ; he exhausted all the Air out of it, and when it was whirl'd round, and the particles of glass put into motion, by the attrition of the hands, the Electricity acted wholly within the globe, and appear'd as a flame of a purple or reddish colour, filling the whole globe, which disappeared by degrees, as the Air was gradually admitted into the globe.
2. Circular strings of threads being fix'd on the Axis in the centre of the globe, and a small distance from each other, the globe being put into motion, and giving a proper friction to it, all the threads extend themselves from the centre to the inner surface of the globe, and nearly represent the spokes of a Coach-wheel, being expanded by the Electricity acting through the pores of the glass.
3. If the hand of a Non-electric be moved towards the surface of the globe, the threads within move every way towards the hand : which shews that the Electricity attracts through the pores of the glass ; and as the electrical particles move towards the hand, they bring along with them the points of the threads.
4. Place a hoop of threads about the globe in motion, and the threads fasten'd to the hoop will be attracted towards the surface of the globe.
5. The Room being darken'd, the ends of the threads on the outside of the globe will appear luminous ; but the threads within exhibit no light.

In these last experiments the globe is not exhausted, as it is in the first: which demonstrates, that when the globe is not exhausted, the Electricity acts outwardly; but when exhausted, inwardly.

A SYLLABUS of the
EXPERIMENTS

Which I Exhibit.

EXPERIMENT I.

A FEATHER being suspended by a hempen or flaxen thread, and held near an electrified body, will be strongly attracted thereby, and adhere immoveably thereto; the Electricity being convey'd away through the thread, as fast as it receives it from the electrified body.

EXP. II.

If a Feather be suspended by a silken string, it will be first attracted, and then repell'd; and continue so till it has touch'd a Non-electric; then it returns again to be electrified, and so on. The Silk will not convey the Electricity away; so the Feather acts as light bodies, that float in air.

EXP.

EXP. III.

All such light bodies as will float in the Air, as thistle or feather-down, &c. or raspings of cork, leaf-gold, several sorts of seed, &c. if nigh an Electrified body, will be attracted, and then repell'd; but if touch'd by a Non-electrified body, before it be out of the sphere of action, it will return to the body electrified, and will be again repell'd. For when these light bodies, being electrified, touch a Non-electric, they lose their Electricity: they are put into the state they were in before electrified, and consequently ready to be fresh attracted.

EXP. IV.

To shew attraction and repulsion at the same time, you must have a little plate of metal, about two inches in diameter, made smooth, and fixed to the gun-barrel so as to be electrified; put some Raspings of Cork, &c. thereon; also take some of the same on the blade of a knife, and hold it under the plate, at two or three inches distance; then laying one of your fingers on the gun-barrel, cause it to be electrified; and when you take your finger off, that which lies upon the plate will be repell'd upwards, and that on the knife attracted upwards at the same instant.

Note, What is attracted upwards, as soon as it touches, is repell'd; and that which lay upon the plate, upon your taking off your finger that instant is electrified and repell'd.

EXP. V.

Suspend a gun-barrel, or any metallic body, by silk lines, and apply the finger to within about half an inch of it when electrified, and you will receive

receive a smart stroke, see the fire, and hear the snap by the Electrical explosion. The electrified body and the Non-electric act equally alike. You may observe the fire to be attracted from the end of your finger, if the top be wet, and approaching the electrified body ; or from the end of a key, &c. if held in your hand. This fire is attracted with vigour from the Non-electric ; and since you may hear a singing noise as it passes through the pores, it is plain it is attracted with force ; and if you move the key a little nigher, the fire comes from the gun-barrel : with great force they meet, and action must cease, if they did not explode. So, according to Sir *Isaac Newton*, whatever attracts with the greatest force, flies asunder with the greatest force, as is above observed ; which any one that tries the experiment might witness that this does, by the percussion they feel when it explodes itself.

EXP. VI.

A person electrified, standing upon Resin or Bees-wax, acts in the same manner as the metallic bodies ; but the animal body being endued with feeling, upon the touch of a non-electrified person, will have the stroke as smartly as from the gun-barrel, and both feel it equally.

EXP. VII.

If wood, stone, &c. whose bodies are not so dense as metal, be electrified, you hardly feel the stroke, the explosion being weak : this effect in bodies being always in proportion to their densities.

EXP.

EXP. VIII.

A person electrified drawing the edge of a sword across the arm, leg, &c. of a non-electrified person, the latter shall feel as if he was cut, and so *vice versa* the same: and if the point be push'd by either against the other, he that receives the seeming thrust shall feel it like a small stab.

This is accounted for in *Exp.* 5. only with this difference, that the drawing the sharp edge of the sword causes a great many of the small but smart explosions; which makes it feel like notching or cutting the flesh.

EXP. IX.

The person electrified holding a sword in his hand, and the Room darken'd, a continual bluish flame issues out at the point in diverging rays; and if a Non-electric holds his hand before it, shall feel a cool blast of wind; the same is felt from the ends of small wires, points of penknives, &c.: and if the non-electrified person holds the sword, and the electrified one applies his hand, the effect is the same.

The gun-barrel, wires, &c. that are suspended, cannot have an Atmosphere so perfect as those bodies that float in Air; nor will they keep their Electricity so long. The lines they are suspended by, the wire, tinsel, &c. that touch the glass globe; and besides, the particles of *Æther* seem to have a peculiar propensity to fly through all Non-electrics that are properly suspended; and being violently push'd forward by fresh particles of *Æther* rushing on these things, must be some hindrance to the perfecting of their Atmosphere; and when the Electricity comes to the extreme ends
of

of the wire, &c. it cannot return back, but flies off in diverging rays of light.

EXP. X.

A person electrified pointing one of his fingers, as if to touch some warm spirits of wine held to him, or set upon a Non-electric, communicates fire to the *effluvia* thereof, which sets the whole on fire. The like may be done to all inflammatory fluids. So if the person Electrified holds the spirits, the Non-electric can set fire to it. The manner the electrical fire meets is explained in *Exp. 5.*

EXP. XI.

A man standing upon the ground takes the electrified phial of water in one hand, and the warm spirits in the other, and brings the top of the wire of the electrified phial nigh the spirits; they will take fire, and he receive a shock. As the fire is attracted from the Non-electric, the same is attracted to meet it from the Electrified body: they attract the fire of each other. In this experiment the phial of water is the Electrified body, and the spirits and person that hold it the Non-electric; and when the two electrical fires meet, they explode themselves amongst the *effluvia* of the spirits, and set them on fire. As for the shocks, they will be accounted for in *Exp. 30.*

EXP. XII.

If you draw water by a capillary Syphon, you may see it come away by drops; but, as soon as electrified, it will run off in a full stream. If the Room be dark, the water will look luminous. Much the same is to be done with a wet sponge.

EXP.

EXP. XIII.

If you stand upon a cake of resin, and touch the back of any one's hand, to shew that you are not electrified, and continue your finger very nigh their hand, while you put your other hand about an inch from the bottom of the syphon, to receive a drop of the electrified water; that instant they will receive a smart stroke on the back of their hand from your finger: and instead of holding the back of their hand, if they were to hold some warm spirits, the spirits would be set on fire, Which shews how much the water conveys it, and how active and great the expansion of Electricity is.

EXP. XIV.

If the pot and syphon be taken in the hand of a non-electrified person, it will only drop; but if it be brought nigh an electrified body it will be attracted, and run a full stream; and the Room being darken'd, the stream will look luminous, as before observ'd: but if brought to the edge of a metal plate that is electrified, the stream will not only look like fire, but you may also observe another fire coming from the plate in diverging rays to meet it, and that in a curve.

This proves the fire coming both from the electric and the non-electric at the same time; and so do several other experiments. If there are two persons, one electrified, and the other not, and each of them wet with spittle the top of one of their fingers, and approach the two fingers to within about an inch, there will issue a bluish flame from each of their fingers, and meet together: and if the fingers

F approach

approach nigher, the stream will become more dense, and explodes, and both persons feel the percussive. Or if they have a piece of thistle-down between them, it will be attracted by the person electrified, and then repell'd ; but, upon the touch of the non-electric person, it loses the Electricity it had received from the electrified one, so flies back to him for more ; thus imitating a shuttle-cock, in its being sent forwards or backwards by the persons that play with it. But if the non-electric person, instead of touching the thistle-down, presents the point of a needle, pin, or penknife, towards it, the thistle-down will be fixed to the electrified body, and not have power to move till the point is remov'd, and then it will be immediately repell'd as before. The same, if the electrified body presents the point ; it then will be fixed to the non-electric. It is certain that the electrified and the non-electric act much alike.

EXP. XV.

If a large plummy Feather be stuck in a cork, and set upon a stand, and so electrified, or held in the hand of an electrified person, it is surprising to see how it will become turgid, the fibres expanding themselves every way from the rib ; but if any of the electric parts in contact (let the distance be what it will) be touch'd by a non-electric, it instantly shrinks, as if sensible of the touch. Thus far it imitates the sensitive plant, but no way solves it.

The downy Feather being animal and dry, the electrical fire will not pass through it: it is not a conductor of Electricity. I have observed, that a body electrified will attract all light bodies, whether electric or non-electric ; and the tender fibres
of

of the downy Feather are expanded, and the small points thereof endeavour to recede from each other, by means of the electrical *effluvia* getting in between the plumes of the Feather; which is agreeable to what Sir *Isaac Newton* saith, when he speaks of our Atmosphere, as being nothing else but the particles of all sorts of bodies, of which the earth consists, separated from one another, and kept at a distance by pure *Æther*, as is above-mention'd: but so instantaneous is the motion, that a Non-electric no sooner touches any part that is Electrified, but the Electrical fire that instant makes its escape through the Non-electric into the floor, and mixes with the universal electrical fire; and as the electrical *Æther* that expands the Feather is attracted from among the *plumulæ* of the Feather, it brings them down with it, which makes them to shrink, as sensible of the touch.

EXP. XVI.

While the Feather is electrified, it looks brisk, as if growing like a plant; and if you bring a small Needle, with your finger before the point, to within 10 inches of the Feather, then suddenly taking your finger away from before the point of the Needle, all its expanded fibres as suddenly contract, and close together.

In the experiment of the Sword, N°. 9. it was observed, that the Electrical body and the Non-electric act alike: and when the Non-electric holds the point of a Needle nigh the Feather, the electrical *effluvia* are attracted from him, through the point of the Needle, in the same manner, and feel like a cool air, as in the experiment of the Sword, whose particles being in different directions to those which expanded the Feather, repel them, and cause the tender fibres to contract.

EXP. XVII.

I have a round copper Plate, suspended by silk lines in the middle of the Room, that serves for several experiments ; and when it is electrified, if there be brought a Leaf of Gold on another Plate, and held under the copper one, the Leaf-gold will be attracted up ; and if the under plate be moved after it, the Leaf-gold will be suspended between the two plates, the proper distance being readily found, the Leaf being nighest to the Non-electric ; but by sticking a little bit of the Leaf-gold to the edge of the under plate, or by suspending of it by the point of a penknife, needle, &c. I have often found the Leaf to be nighest to the electrified body.

The Leaf-gold, in my opinion, is suspended by the mutual attraction ; the upper plate, being electrified, would electrify the Gold, and repel it ; but the Non-electric, being moved after it to a proper distance, takes off the Electricity as fast as the upper plate electrifies : so one attracts to electrify, the other to take it off ; and the Leaf has its attraction both ways. If, instead of the under plate, you hold the back of your hand, you will find the electrical fire blowing like a cool wind against it : it is plain that what fire the Leaf-gold receives from the Electrified body, it bestows upon the Non-electric.

EXP. XVIII.

I have a large Pewter plate, laid on a proper stand, and a circular Rim of Brass, with three feet made of Sealing-wax ; and when I put this Rim of Brass upon the Pewter, I electrify it by a small wire ; the feet of sealing-wax prevent the pewter plate .

plate from being electrified, and support the brass Rim about half an inch from the pewter. The Rim is made in the shape of that which is thought to be described by the Earth in its revolution about the Sun : I have also some Glass balls about an inch and quarter diameter, blown very light ; and when I put one within the brass Rim, and nigh the brass, it will be attracted, turn upon its Axis, and revolve at the same time ; which, in some measure, imitates the earth in its Diurnal and Annual motions.

In this experiment is shewn the mutual attraction ; the Pewter Plate takes off the Electricity as fast as the brass rim electrifies the glass ball : if it was not to touch the Pewter Plate, it would be first attracted, and then repell'd ; and, being glass, it will be electrified mostly at that part which touches the electrified body ; it does not act like to a ball of iron or copper, &c. which would become electrified all over alike. The glass sphere can't touch the brass rim but at one point at a time ; and, consequently becoming the most electrified at that point, and in some measure repell'd ; and then a fresh point of the sphere attracted, and in the foregoing manner repell'd ; and by this means it is caused to turn upon its Axis, and to revolve.

EXP. XIX.

Darken the Room, and the glass Ball will be beautifully illuminated in its revolution, but more particularly at its poles.

EXP. XX.

I have another flattish Rim, made in the form of an egg, and with that I can make two Balls run, one within, and the other without ; one from East to West, and the other from North to South,
at

at the same time. When I first discover'd this experiment, I made the little glass ball to revolve round a large copper ball.

N. B. I could make as many of these Balls to revolve as there are Planets.

EXP. XXI.

Take a well-shap'd Rabbit's Bladder; let it be well-clean'd, and blown up tight; tie the end with some sowing-silk; this I call the upper end: stick to the bottom some gold Leaf, letting a little hang down. This serves to regulate its motion, as a flie does to a piece of Clock-work; for without this it would be only attracted and repell'd. I hung upon the gun-barrel a copper-ball, about four inches diameter; it was hollow, turn'd smooth, and polish'd: when I electrified it, I brought a bladder in a salver, and held it under it: the Ball being electrified, and the Salver not, I suspended the Bladder, which seem'd to hang by a string of fire. When this experiment succeeds well, from the bottom of the Bladder to the Salver are seen diverging rays of fire. The ends of the Bladder I call its poles; for it keeps turning all the time of its suspension; wherefore it acts like the sun, revolving upon its own Axis.

The Bladder is suspended, as Leaf-gold, by the mutual attraction. If you hold the back of your hand under the Bladder, you will have a much stronger current of Æther blowing against it than in the experiment of the gold Leaf. It is surprising (some will say) how a current of Æther, setting through the Bladder, should suspend it! I have observ'd, that the excited globe has the power of attracting and loosening this electrical fire from the watry and earthy particles that restrain'd it; that

that bodies electrified are endued with the quality of attracting the particles of *Æther* that are in Air; that the particles of *Æther* have undoubtedly the virtue of attracting; and as they are attracted by the electrified bodies, they bring along with them all light bodies that are in their way. In this manner I imagine the Bladder or Leaf-gold, &c. to be kept nigh to the copper ball electrified, by the particles of *Æther* being attracted in all directions to it; that the current of *Æther*, which we feel like cold air against our hands, is the Electrical fire that would repel it, and not that which did attract it towards the copper Ball: but the Non-electric, being held pretty nigh, takes off the electrical *effluvia* as fast as they come from the electrified copper Ball, and prevents its forming an Atmosphere to the Bladder, whose pulses would tend to the centre of the Bladder, and be in different directions to those of the copper Ball. I say, it prevents it from being strong enough to repel it. And here we find the *Æther* attracted to act stronger (being help'd by the Non-electric) than that which comes from the copper Ball.

As there is the force of Gravity against its suspension, if we consider the fresh influx of *Æther* continually coming into the Ball, by means of the excited glass globe; and the efflux going from the copper Ball, by or through the Bladder into the Salver, and through the Person that holds it, and so into the Floor, whence it mixes again with the universal pure *Æther*, and at the same time allow, as we have observ'd, that the copper Ball will attract the particles of *Æther* in all directions, I conclude the action of these particles, in such different directions, must be the occasion of the Bladder turning upon its own axis.

EXP.

EXP. XXII.

Take a thin glass Phial, fill it two thirds with water, and let it be well-cork'd, with a wire passing thro' the cork nigh to the bottom of the Phial, leaving the upper part of the wire about six inches above the cork; then bend the wire, so that it may hang upon the gun-barrel: if you hold the Phial in one hand, letting the wire touch the globe while in motion, or the gun-barrel while electrified; by this means the water becomes electrified; and if you attempt to touch the upper part of the wire with a finger of the other hand, you will receive a strong shock at the elbows, sometimes across the breast, and sometimes all over the body; especially if the person be subject to the Rheumatism, or paralytic disorders.

EXP. XXIII.

Take a piece of gilt Leather; hang it to the gun-barrel by a couple of bent wires, and electrify it; then approach to touch it with a large Key, or any substantial piece of Metal, and the electrical fire will dart in a surprising manner on the metallic surface, and very much resemble Lightning; the Leather being a little rumpled will make it act the better.

Leather, being dry, cannot be electrified; but the Metal upon it will; which, being laid very thin upon the Leather, and being very porous withal, numbers of little parts not touching, upon the approach of the knuckle, or a substantial piece of metal, the electrical fires are attracted from both; which, meeting, explode, and are seen upon the metallic surface in numberless explosions, or little sparks of fire darting about in different

different directions, and those in a most beautiful variety of colours, which very nigh resemble Lightning.

EXP. XXIV.

Electrify a piece of gilt Leather, and a Phial of Water, at the same time ; with a pair of tongs take hold of the Phial, and with the head of the tongs touch the Leather, and there will be a very loud Report, and a Light sufficient for any body to discern every feature of those who stand nigh it, if the Room be made dark. As the other imitates Lightning, this may be said to imitate Thunder. The reason for its acting so much stronger is accounted for in *Exp.* 30.

EXP. XXV.

To the gun-barrel suspend an Egg by a small wire, and the Phial of Water at half a yard's distance from the Egg, and electrify them. Take hold of the Phial with one hand, and move the palm of the other slowly towards the bottom of the Egg ; and when it comes to within half an inch of it, you will receive a smart stroke ; and though you were ever so determin'd not to touch it, you cannot forbear hitting it ; at which time it gives you a shock, and very sensibly affects the arms.

One might think this may help to account for Muscular Motion ; for it has this effect upon the nerves, to cause the muscles to be contracted the natural way. If I hold the palm of my hand under the Egg, my muscles, being contracted the natural way, make me strike the Egg ; but if I apply the back of my finger, the muscular contraction naturally hinders me from striking it.

EXP. XXVI.

Hang the Phial of Water at one end of the gun-barrel to be electrified. Here you may observe, that the Phial I make use of is about 12 inches high: the lower part and bottom, for this experiment, I cover with gilt Leather, almost 7 inches; so that the cork-part and 4 inches are left uncover'd. When I cover it, I work a piece of wire in with the Leather, so as to make a small loop just at bottom, which serves to hook one end of a large Jack-Chain to, of about 6 or 8 yards in length, or longer if you please; so laying the Chain round the Room, take hold within 7 inches of the other end of it, which 7 inches of Chain must hang downwards, holding your hand about 4 inches higher than the gun-barrel, as if going to touch it with the end of the Chain, which when brought within a proper distance, it will snap, and the whole Chain become illuminated.

1. This experiment is upon the very same principles, as when the whole company join hands; and it plainly shews how the electrical fire darts through the company in that experiment. 2. If one part of the Chain is laid upon the other, it will not affect any superfluous part; but takes the readiest way from the Phial to the Gun-barrel, and from thence to the Phial. 3. In the same manner, if a person stands upon the Chain, and approaches with a knuckle to the gun-barrel, he will receive a shock in the arm and legs, especially in that next the Phial: so that the nighest way is from the Phial to the feet of the person that stands upon the Chain, through them to the Gun-barrel, or from the Gun-barrel through the person to the Chain, and so to the Phial. 4. If any number of persons communicate by pieces of Wire, and one of them brings together the ends of the two pieces of Wire
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in his hands; upon touching the gun-barrel he will receive no shock; the Electricity having no occasion to pass through him, as finding the readiest way through the Wires. 5. The Chain looking luminous is owing to the links, and the manner of their linking together, which does not cause them to touch; and it is in those parts which do not touch that we see the electrical fire; its explosion being confin'd to those parts only.

EXP. XXVII.

A person standing upon a cake of Resin, holding the Phial of Water by the Wire in one hand, and a Bason of Water in the other, and is electrified; another, standing upon the ground, grasps the lower part of the Phial with one hand, and endeavouring to touch the middle of the Water in the Bason with one of his fingers of the other hand, or with a large Key, they both receive a shock.

N. B. It is to be observ'd, that, at the approach of the Finger or Key to the Water, the Water rises up in a small cone, and a snap is to be heard, and the fire to be seen, especially if the Room be dark.

Query, Whether the Water's rising up in a small cone might not help to account for the Water-spouts at sea?

EXP. XXVIII.

If a Lady electrified stands upon Resin, and holds the Phial of Water by the Wire in her hand, and a Gentleman grasping the lower part of the Phial, as he stands on the ground, and if both endeavour all that is in their power to salute, they cannot: no sooner do their heads come within about half an inch of each other, but they meet

with a mutual rebuff, that will cause them to fling their heads back much quicker than they endeavoured to meet. They are very apt to clap their hand to their face, as if it were to feel whether their head be in its place; for it makes it ring, and causes them to forget that they were going to salute. This shews the effect it has upon the nerves to make the muscles contract the natural way; for the chief muscles of the neck are in the back part of it.

EXP. XXIX.

Get four Pillars, about fourteen inches high, fix'd at the bottom to a board twelve inches square, to keep them firm; upon the top of the Pillars lay two pieces of Wood across in right angles; get 5 small Bells, hang the largest where the two pieces touch that are laid across upon the top of the Pillars, which is the centre, by a piece of silk line, to keep the Bell about 3 or 4 inches from the Wood; the other 4 you must hang round the Centre-Bell by small Wires; the bottom of each of these Bells must be about an inch and quarter from the bottom of the Centre-Bell: these Bells are to be without Clappers; but something like a Clapper must be hung by sewing silk, between the central and each of the other 4 Bells. The Clappers and the 4 Bells may be hung by making a sort of loop to the silk, and the wire by which they are supported, that they may be moved nigher to or farther from the Centre-Bell, as requisite; then convey a Wire to the Centre-Bell, which you electrify by itself, because it is suspended by Silk; and the Clappers being hung by Silk, will be attracted by the Centre-Bell electrified, and repell'd against the 4 outward Bells, which (being hung by Wire) takes off the Electricity from

from the Clappers, and they are again attracted and repell'd by the Centre-Bell, &c.

EXP. XXX.

Let one take hold of the electrified Phial of Water pendent to the gun-barrel, the whole company joining hands, the last having one hand at liberty, with which he is to attempt to touch the gun-barrel; but at the approach of his finger, or one of his knuckles, to within half an inch of the gun-barrel, the whole company receives an instantaneous strong shock. This experiment may be tried upon any number of persons at once.

To help to solve this experiment, I am going to mention another.

If a person stand ready with the Left-hand to touch the gun-barrel, &c. with one of his knuckles, and a second person put one finger of the Left-hand on the back of the Right-hand of the First person, and in the same manner a Third on the back of the Right-hand of the Second person, and so on, and the First person approach his knuckle towards the gun-barrel, he receives a smart stroke as usual on the knuckle; but all the rest, at the same instant, feel a sensation like a strong pulse, beating against the finger of their Left-hand, and in the back of their Right-hand; except the last person, who is hardly sensible of it.

In this experiment the whole company is affected, though but weakly, (they receiving the repulsive force but one way): but, in this experiment, we find the Electricity flying through the whole company, before it gets into the floor. But if the first person grasps the Phial of Water, and all the company join hands, the last person of the line approaching with one of his knuckles
towards

towards the gun-barrel; at that instant all the company receive a strong and surprising shock.

I have observed, that all the fire does not come from the Electrified body, but it attracts fire from the Non-electric; and at the same time fire comes from the Electrified body, to repel it: when these two fires meet (if the expression be allow'd me) the particles being the same. *viz.* the Electrical fire or Æther, only attracted in different directions, which cause them to repel one another, I say, when they meet, if the Electrified body has not power to repel the Non-electric, it causes the explosion which we hear, and feel the violence of when it flies asunder. But to the point; when the last person approacheth the gun-barrel with his knuckle, the company begins to attract the Electricity from it, and that from them, for if we consider, the whole company joining hands acts as one body, and, at the same time, the electrified Phial begins to exert itself, and to attract the Æther from the Company towards it, and the Company to attract the Æther accumulated in the Phial towards them. In this position the Non-electric attracts every way from the Electric body, and the Electrified body every way from the Non-electric, and the Electricity ready to break forth into action, upon the nigher approach of the knuckle like gun-powder, which the more it is compress'd the more it explodes. Upon the nigher approach of the knuckle, the repulsive force breaks through the Phial (it being of thin glass), and with violence repels the Electricity through the whole company one way, and the repulsive force darts through the company the other way from the gun-barrel; so when the particles of Æther meet in different directions, they always repel each other; and in this experiment they

they meet in each person that is in contact, and the repulsive force is felt within them, which causes that surprising sensation, which they all feel at the same instant.

EXP. XXXI.

Turn a piece of pumice-stone round, and as smooth as possible, making a hole in it for a wire to be thrust through the centre, to serve as poles to turn it by ; dip it in water, then stand upon a cake of Resin, and be electrified, turning the pumice gently upon its poles ; then let a Non-electric be held near the ball electrified, the water on the surface will be seen to rise always towards the Non-electric. This experiment might help to account for the Tides ; which was the opinion of Mr. *Wilson*, who discover'd this experiment, and that of the silver Leaf.

EXP. XXXII.

Suspend a copper Plate of about 10 inches diameter by silk lines, and electrify it ; get a Pewter Plate sixteen inches diameter ; fix it upon a stand that may be moved up and down upon occasion ; place it under the copper Plate, move the stand upwards to within 6 inches of the Copper Plate ; then if you set on the Pewter Plate upon their feet some grotesque figures, such as Harlequin, Punch, Pierrot, &c. drawn upon and cut out of very thin paper, you will have a delightful entertainment in dumb shew, the figures dancing in a brisk manner, and as if they had some design in what they were about.

This is really a diverting and surprising experiment ; for each of these little figures form to themselves an Atmosphere, of an elastic nature, which

which prevents their touching each other ; and if you move your hand towards them, they seem to be pushed from you, by that time you come within two inches of them.

This is agreeable to Sir *Isaac Newton's* Æther, which he says keeps all the particles that impregnate the Air at a distance from each other ; but if one of these little figures, full as tall as the others, should happen to be much lighter than the rest, it will be attracted and repell'd, and cannot be at rest till it becomes join'd to another : upon its being attracted to the Upper Plate it becomes electrified, and often by that means will attract another to it. There is also an Atmosphere immediately form'd to them both ; which makes it something resemble matrimony, for they dance as one body, as long as their spirits will suffer them.

A silly fellow, that advertis'd against this experiment, after a fulsome puff of himself, says as follows :

‘ Where it is presumed no late improvements
 ‘ will be expected (no, I believe not—of *his own*)
 ‘ to be added to the course, but such as, in their
 ‘ own natures, afford matter for the most solid
 ‘ Inquirers ; such as may probably lead us to
 ‘ the cause, and thereby point out some grand
 ‘ and important effects, instead of those Emblematic
 ‘ dances the ignorant boast of, which tend
 ‘ to debase the noblest principle in nature, by bringing
 ‘ its properties into contempt and ridicule.’

Why ? because they are diverting ? Does not the mind require some relaxation ? Would he have others as dull as himself ? But the true cause, as I take it, was my refusing to shew him the experiment of the Chair and Crown ; and telling him at the same time he had us'd me ill, in advertising
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the last experiment I had shewn him as his own, making the greatest puff of it, and calling it *His Electrical Orrery*. He is, in his *own* opinion, a Great Philosopher ; but can't persuade any body else to think so ; people being obstinate, and of another opinion.

I expect that some of those ingenious gentlemen, that sell Twelve-peny Chops of Electricity as well as myself, will advertise against me and my book ; but I am contented, as it may be a means of sending me customers, both for the Book and Electricity.

EXP. XXXIII.

The method I made use of to separate the Electrical fire, or Æther, from those particles that clogg'd it, was, by getting a Glass Receiver made in the shape of a Crown : the top of the glass Crown had a neck like to the end of one of the glass globes which we make use of ; to this neck I fixed a Cap of Brass, with a stop-cock in the shape of a cross ; in the inside of the Glass I put a Tin Plate, cut round like the top of the Glass, and dividing the Tin Circle into eight parts ; I had the Tin cut in points like the middle part of a fleur-de-lys, and turn'd downwards, with an intent, that when the top was electrified, these points might convey the Electrical fire to the bottom, which is a Plate of Brass, and acts as a Non-electric, and attracts the Fire from the Top Plate, which is to be electrified ; then fixing it to an Air-Pump, I exhausted all the Air I could out of it. I had a Chair made, with a Back to move up and down at pleasure ; from the top of the back was a projection, of about 9 inches, over the seat of the Chair, wherein a circular cavity was made to receive the Bottom of the Crown ; and when any person sat in it, by means of the Back moving up and down,

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I could place the Crown on the head of the person sitting in the Chair ; over the top of the Crown I hung a Plate of Metal, about five inches diameter, to move up and down like a chandelier : this Plate I could electrify by a wire I convey'd to it ; so when I perform'd the experiment, I mov'd the Plate so nigh the Crown, that, when electrified, a continued stream of Fire would appear between the Plate and Crown, and the Crown look luminous, as if almost fill'd with fire, by numberless rays of light darting in different forms from top to bottom in a glorious manner.

I must here observe, that the Person and Chair are not electrified ; there being no resinous body between them and the boards ; yet the Person sitting in the Chair will receive so much of the Electrical fire, that it shall be very sensibly both felt and seen by any one that attempts to touch him.

The first time I made this experiment was about 3 years ago ; but once, as I was exhausting the Receiver, it burst, and cut my face, which deterr'd me from going on with it ; tho' at this time I have a proper *Apparatus* to shew this experiment, which intirely destroys the doctrine of *Capsula's* or *Cases*, by some asserted ; as imagining that the Electricity does not pass through the Body electrified ; but it is very plain that it does ; for otherwise it could never be convey'd into the exhausted Glass Receiver.

EXP. XXXIV.

If you apply a common Loadstone arm'd with iron, or one of Dr. *Knight's* Artificial Magnets, to the gun-barrel when not electrified, by its attraction it adheres to the barrel ; and to the end of the artificial one, a Key, &c. then electrify the
gun-barrel,

gun-barrel, and you will find the Electricity will not interfere with Magnetism. The Magnets, both real and artificial, becoming electrified, not only admit the Electrical fire, but attract and repel in all directions all light bodies by the power of Electricity; and at the same time the Electricity no-ways impedes the action of the Magnet.

EXP. XXXV.

At the beginning of this book, the reason that I gave why Glass should have the power of attracting the Electricity was, that the chief composition of Glass was Fire or Sulphur; which made me conclude, that a Globe made of Sulphur only would serve to perform the electrical experiments as well as a Glass one: whereupon I made a Globe of Sulphur about 14 inches diameter, and found it answer exceeding well, and better than Glass. If a person holds all the fingers of one hand over the Sulphur-Globe, when excited, and even at three inches distance, there will be streams of fire attracted from all the pores of the fingers; and as it rushes upon the globe, it makes such a hissing noise, and gives so much light, that really it is enough to startle the person that tries the experiment.

I have only observed this difference as yet between the Glass and Sulphur Globes, that if the Point of a Sword or Wire, &c. is held by a person electrified by a Glass Globe nigh to a Non-electric, a bluish flame will issue from the point: but, if held by the Non-electric towards the Electrified person, then the point of the Sword or Wire becomes only illuminated; but just the reverse, if the same experiment is tried with the Sulphur Globe, which cannot be excited to any height by hands, or leather cushion as the Glass Globe

is ; but may, by means of folded linen between the hands and globe, be excited to a very high degree.

A Candle being just blown out, and held between an Electrified and a Non-electric body, so that the electrical stroke might pass through the snuff, it will light up the Candle.

N. B. I always succeeded in this experiment when I made use of the Sulphur Globe.

Our experiments do not succeed well in damp, foggy, or hazy weather ; the Electrical fire being then so much employ'd in saturating and supporting the Atmosphere, that we can attract but little Electricity from the Air ; besides the watry and earthly particles, which at those times the Air is charged with, settle upon our silk lines and supporters, and by that means cause them to convey part of the Electrical fire into the earth, instead of repelling it.

When vapours, exhalations, &c. that are attracted into the Air, are driven by the winds in greater quantities than ordinary over that part of the habitable globe which we reside on, then we say it is gathering for Rain. The reason of my saying, the watry and earthly particles are driven together by the winds, is, that when we see such heavy clouds that seem ready to deliver their loads in kind and friendly showers, and sometimes in tempestuous ones, if a strong wind arises, we find they are removed by the winds from over the threatened place to another, and there descend in rain. It is observed of those days, when the Atmosphere is fullest of matter, that the pressure of the Air is least.

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I have observed, that the *effluvia* of the Earth being attracted into Air become electrified, and the particles of these *effluvia* repel each other; and when the electrical *Æther*, which is diffeminated throughout the universe, becomes clogg'd by the *effluvia* of the Earth over any one part of this globe, it cannot act with so much vigour as it did before, the spring centrifugal, or repulsive force, being weaken'd. But when *Æther* is overcharg'd by the *effluvia* of the Earth, and no longer able to support those *effluvia* against the Earth's attraction, they then descend to the earth, to assist in the new generating and nourishment of Animals and Vegetables; and while they descend to the Earth in one part, they are attracted from the Earth in another, to keep up the round of Generation.

We have had an account of one cured of a Paralytic disorder, by being electrified; and of a woman cured of an Apoplectic Fit, who was electrified and blooded.

One of my acquaintance, who had a violent Crick in his Neck, I electrified, and gave him a shock or two in the head, which immediately cur'd him.

Another that had been terribly troubled with the Night-Mare, or being hag-ridden, so that he had not slept for 7 or 8 nights, and at times, when he was likely to go to sleep, he would start from it, and be in all the agonies imaginable; but, upon his being electrified, and going through some of the shocks, he went home, and slept as well as ever. I have seen him several times since, and
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he informed me, that he has not had any return of it; but, if ever he should, he would be electrified again.

The CASE of John Dew, written by himself.

May 26. 1747.

ABOUT nine months since I was playing at Billiards, and blew one of the balls out of my mouth for a considerable time, as nigh as I can judge about two hours. Afterwards, I was not very well all that day: and to my surprize, in about a week's time or less, I had a small swelling on the right side of my Groin; which I did not take a great deal of notice of, till about three months afterwards I perceiv'd it to grow somewhat bigger, though with little or no pain; but, fearing bad consequences might happen in time, I applied to a person of judgment, who told me it was a wind-rupture; upon which I bought a truss, and applied it to the part affected. When I had worn it about two months, I found the wind began to fall into my *scrotum*, which at first was not very big; but finding it to increase more every day, even to a very large size, I began to be in a very great concern about it. When I was us'd to squeeze my *scrotum* with my hand, I could feel the wind come into my belly, which caus'd me to belch; but if it happen'd (as it sometimes would) that I could not break wind, it would instantly fly into my head, and make me so giddy, that I have hardly been able to stand; sometimes it would settle in my breast, or under my ribs, which occasion'd great pain, and my *scrotum* us'd to be so fill'd with wind as to be painful in walking. I having heard of the surprizing experiments in Electricity, had the curiosity to go to Mr. Rackstrow's in Fleetstreet,

Fleetstreet, on *Friday* the eighth instant, to see them perform'd; where I received but one shock, which had an emotion on my spirits all the same day; and at night, putting my hand down to my *scrotum*, to my surprize I found all the wind dissipated from that part. I told a person belonging to Mr. *Rackstrow* of the effect it had on me; he advised me to come again to be electrified; but, being obliged to go into the Country, the *Tuesday* following, I walked very nigh an hundred miles by *Friday*, when I return'd again to *London*; and the next day, which was the 18th instant, I went to Mr. *Rackstrow* again, where I received the shock 4 times. This put me into a violent sweat. Ever since, blessed be God, I have continued in a tolerable state of health; and now at this writing the wind has quite left me. This I attest to be true.

J. D.

This person receiv'd the shock standing upon the Chain that I hung to the bottom of the electrified phial of water, by approaching his knuckle to the Tube electrified, to make the circle good, and at that time the Electricity must pass through one of his thighs, and possibly might affect the ailing part; the fluids where the Electricity passes through being put into a violent agitation, the particles being electrified repel each other with violence, and, consequently, may not only break the bubbles of wind, but quite remove the cause; as I have found by experiments upon them that have been afflicted with the Gout, or Wind in their Stomach, who, upon their receiving the shock across the breast, have been immediately cured.

It has been proved by experiments, both at home and abroad, that Electricity is not only Light, but that it flies with the same rapidity. Both antient and modern philosophers agree, that æthereal Light or Fire is diffeminated throughout the universe, that the particles of all bodies, and Air, are kept at a distance by it, that the particles of this Fire, being clogg'd by earthy and watry particles, become less active ; but such earthy and watry particles as cohere with Æther, more active ; its attractive and repulsive force, with its great expansion, &c. convince me, that Æther and our Electrical fire is one and the same thing ; and farther induces me to believe it to be the very same which *Homburg* means by his Sulphur, and Sir *Isaac Newton* by his Acid ; and that the ancient doctrine of elementary Fire will be re-established.

I know I am pulling on myself the indignation of some ; but I believe, if Sir *Isaac Newton* was alive, to see the experiments we now make in Electricity, he would allow of Elementary Fire himself. In the account we had from Mr. *Le Monnier*, it appears that he had kept a bottle of water electrified 36 hours : I have kept c. for ten hours. There is but little motion to create Fire in this experiment ; and I cannot imagine that we can add one particle to pure Fire, or destroy one.

I have found out some experiments myself relative to the Planetary System ; such as the glass Ball which turns upon its Axis, and revolves at the same time, which in some measure imitates the Earth in its diurnal and annual motions. 2. A small piece of Leaf-gold, which I suspended to the

the edge of a Copper Plate, revolved round it like a Comet. 3. A Rabbit's Bladder, which, I suspend, will keep turning upon its Axis like the Sun, or one of the fixed Planets. In short, I find that all bodies in the state of suspension, have a tendency to revolve, and turn upon their Axes: which is enough to make us think that this Electrical Fire is the cause of the Planets being kept in their places to turn upon their Axes and revolve.

If this rude essay of an Unlearned Fellow should give some hints to such as are willing, and capable of writing upon this subject, and some amusement to others, whose hands it may happen to fall into, I shall be well pleased: if not, I shall be heartily sorry for the trouble I give my readers.

F I N I S.

B. RACKSTROW,

*Figure maker and Statuary, at Sir Isaac
Newton's Head in Fleetstreet, London,*

TAKES off Faces from the Life, and forms them into Busts to an exact Likeness, and with as little Trouble as sitting to be shav'd: Makes all sorts of Figures in Plaster, with Ornaments for Doors and Chimney-pieces in the neatest Manner, to represent either Marble-Stone or Terracotta.

N. B. He likewise makes and mends leaden Figures, Vases, &c. for Gardens and Fountains,

*He also takes this Method to acquaint the
Curious,*

That he has begun to exhibit his Electrical Experiments, such as the Chair of Beatification, which proves, beyond Contradiction, that Electricity passes through the Pores of all Bodies, with its setting Fire to Exhalations, Vapours, and all inflammatory Fluids; which assists in demonstrating the Similarity of Electricity to Lightning and Thunder, with all the other most curious and extraordinary Experiments invented either abroad, or in this Kingdom; with his own Experiments relative to the Planetary System, and the Sun's illuminating the Earth. But he begs to be excused exhibiting to less than Three at a time; and, if requir'd (upon Notice given the Night before) the Experiments shall be perform'd by a Sulphur Globe, of about fourteen Inches Diameter, which acts better than Glas. Price One Shilling each Person.

N. B. The Reason of not using the Sulphur Globe in common is, because it is much more liable to break than a glass one.

*At the same Place may be had, just published,
Price 6d.*

A Treatise on the Circulation of the Blood, and the Communication between the Mother and the Fœtus; with an Explanation of the Figure of an Anatomy, wherein the Circulation of the Blood is made visible thro' glass Veins and Arteries, with the Action of the Heart and Lungs; as also the Course of the Blood from the Mother to the Child, and from the Child to the Mother; by which means any person, tho' unskill'd in the Knowledge of Anatomy, may, at one View, be acquainted with the Circulation of the Blood, and in what Manner it is performed in our living Bodies. Adorned with a Copper-Plate; wherein the Structure of the Heart is design'd, and the glass Vessels exactly represented in their Order, as they are in the Figure, to which they are to be referr'd.

N. B. This Figure, and several other curious anatomical Preparations, with Variety of other Curiosities, are to be seen at *B. Rackstrow's in Fleetstreet, at One Shilling each.*

To the Honourable the
MEMBERS of the *Academy*
of *Sciences at Bourdeaux.*

Learned Sirs,

HAVING found, by an Advertisement in one of our public Papers, your Desire of knowing the different Opinions of People upon the Similarity of Electricity to Thunder and Lightning, I humbly offer my endeavours in the manner following.

Sir *Isaac Newton* says, that there are always sulphureous exhalations ascending into the Air, when the Earth is dry; there they ferment with nitrous acids, and sometimes take fire, and generate Thunder, Lightening, &c.

In shewing some experiments in Electricity, I once made use of a phial which before that time had oil of vitriol in it; I put water into it, and electrified it as usual; I used it about a day and half; in which time no accident happen'd; and then, on a sudden, as I was shewing the experiments, it exploded with great violence, and a loud report, and with a flash like Lightning; tho' at that time, and for a considerable time before, no one had touch'd any thing that was electrified. The bottom of the phial I found in a perpendicular, under the place where it had hung; the cork and wire

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remained

remained hanging in their places ; but all the other parts and the water were forcibly repell'd all over the room. The pieces of glass I found upon the Drawers, Table, and Chairs, that were in the room ; and observing where my cloaths were wetted by the water, I found the colour discharged ; which made me recollect there had been Vitriol in the phial.

When I consider, that the composition, or contents of the bottle, was a good deal of water, with a very little Vitriol or Sulphur, which, with the Electrical fire accumulated therein, had caused this great explosion ; I imagined it not improbable, that *Æther*, meeting with the nitro-sulphureous and watry particles in the Air might be the cause of Thunder and Lightning. I believe, that, by our discoveries in Electricity, we may account for several *phænomena* ; such as the Northern Light called *Aurora Borealis*, Exhalations, Ebbing and Flowing of the Tides, subterraneous Fires and Vulcano's, such as *Ætna*, *Vesuvius*, *Hecla*, &c. Earthquakes, muscular motion, and the Winds.

The effects of Thunder are so like those of gunpowder fired, that Dr, *Wallis* thinks we need not scruple to ascribe them to the same cause ; the composition of gunpowder being Nitre and Sulphur ; Charcoal only serving to keep the parts separate, for the better kindling.

We may conceive, from what Sir *Isaac Newton* asserts, that there is a convenient mixture of nitrous and sulphureous particles in the Air ; which being set on fire, there follow both noise and light, as in the phænomena of Thunder, &c. and will run in such directions as the exhalations lead to, as is found in a train of gunpowder. I

I shall now prove, that Electricity is capable of setting those nitro-sulphureous particles on fire, and am very certain no one can prove that they can be fired without the assistance of the Electrical Fire in the Air.

Electricity will not set fire to bodies that are fixt, but to such as are in a volatile state, as all inflammatory fluids are; and a Candle just blown out being held between a non-electric and an electrified body, so that the electrical Stroke may pass through the snuff, the Candle will be thereby re-lighted.

Mr. *Watson* made an experiment with File-Dust and Vitriol mixt with Water in a bottle, which caused an ebullition and heat; and if a person electrified holds his finger to the mouth of the bottle, the exhalation or vapour that arises takes fire and explodes (and would burst the bottle, were it not to have a wide mouth) and so burns like a volcano. I am well aware it may be objected that such or the like compositions will take fire of themselves. My answer is, I have tried several times the composition here spoken of, but never found that it did take fire of itself; tho' it never failed taking fire upon the approach of an electrified body; even of Water, when electrified, and suffer'd to run into it: but if any such should take fire of itself, can any one assert that it would do so, without the assistance of the Electrical Fire in the Air?

The followidg experiment will prove in a stronger manner the firing of sulphureous exhalations by Electricity, which was told me by Mr. *John Pinchbeck*, viz. that at *White-haven* in the County of *Cumberland*, the sulphureous exhalations arising

from a Coal-mine, and confined to pass through a tube, being set on fire, serve as a Light-House; and it is a generally received opinion, that it would be fatal to that mine to carry a lighted candle into it; but the practice there is to make use of steel, formed like a grind-stone, being swiftly turn'd upon its axis, and, at the same time, a piece of flint applied thereto causeth such a number of sparks to fly off, as to afford the miners sufficient light to work by, those sparks not being capable of setting fire to the exhalations, &c. as Electrical or other flames would do.

One of *Coborn's* grenades I filled with pit-coal broken small, and fixed to it a small gun-barrel, and at the other end of the barrel a small pipe (a tobacco-pipe will do) and to the end of the pipe tied a bladder, having taken care that all the junctures were well luted, that when the Cohorn was set on the fire, the sulphureous exhalation might pass through the tubes, and fill the bladder: I then took the small pipe and bladder from the barrel, and stopped the end with wax; and, when minded to try the experiment, I took away the stopper, and as the exhalation issued from the end of the pipe, applied it to a body electrified, and it took fire from the electrical stroke, and burnt like a candle, but, upon stopping it, it went out, and served me for the same experiment several times.

It is said, that at *Flasblun* in *Sweden*, noted for copper mines, the mineral exhalations affect the air so sensibly, that their silver coins are frequently discolour'd in their purses, and the same effluvia change the colour of brass.

Mr.

Mr. *Boyle* was assured, by a gentleman who profess'd some ground wherein were several veins of metals and other minerals, that he had frequently seen pillars of fume ascending thence ; that in *Carniola*, *Campania*, &c. where there are mines of Sulphur, the Air at certain times becomes very unwholesome ; that mines near the *Cape of Good Hope* emit such horrible fumes from the Arsenick in them, that no animal can live near them, and that such as were at any time opened, were obliged to be immediately closed again. From whence it is evident, that at all times there are immense quantities of exhalations, vapours, &c. attracted from the earth into the Air ; where, becoming saturated with electrical *Æther*, those particles acquire that centrifugal force which Sir *Isaac Newton* attributes to Air.

If you cut some Gold or Silver Thread, Tinsel, or very fine Wire, into pieces of about half an inch long, and hold them on a salver under a metal Plate electrified, they will be attracted up ; but, meeting with the body electrified, a number of small explosions will be created, and they become electrified, and with greater force repell'd than when attracted up to the electrified plate ; and, undoubtedly, if the motion of those pieces of Wire, &c. was not so quick, but would give time, so that, by the application of one's hand, we might feel the electrical blast, as we do from the points of penknives, needles, &c. we should see the same bluish flame as from them.

The exhalations of all such Non-electrics as Metal, being attracted into Air, and there meeting with such sort of exhalations as themselves (already saturated with electrical *Æther*) cause such innumerable small explosions, that the part of the
heavens

heavens where they are seems to shiver and shew those streams of flashing Lights which are called *Auroræ Boreales* or the Northern Lights; the North abounding with metallic Mines, &c. more than any of the other parts of the globe. In the same manner Thunder and Lightening may happen, when the exhalations are in greater quantities, and more dense.

Let us suppose a column of mineral exhalations, or aqueous vapour, ascending into Air by the sun's attraction and subterranean heat, assisted by the æthereal or electrical Fire, which is ever restless, and pervading the pores of all bodies, and this I conceive to be the Spirit of the Air, which assists in the production of all things, according to the *Matrix* or different pores of Earth it uses to meet with; for, having the quality of attracting from the Earth the effluvia of each constituent part thereof, it gives to them fluidity, and conveys them along with it; and as it passes through the pores of terrestrial bodies that have lost their volatile part, these bodies will attract to themselves each their proper effluvia, and fix them; which has been observ'd in a great many different bodies, and particularly in different Salts, which having had their Spirits distill'd from them, and they exposed to the air, have in a short time considerably increased in their weight, and fresh Spirits drawn from them, and so for 8 or 9 times successively.

But as to the exhalations, &c. ascending into Air (from which I have digress'd) they meeting with a Cloud saturated with electrical Æther, which Cloud assists in attracting the effluvia towards it, as light bodies are attracted by a body electrified; and, though brought by the electrical
Fire

Fire in the Air towards that body, are not filled therewith, until they touch the body electrified, and then are immediately repell'd, the effluvia ascending to meet the electrified Cloud in a fainter manner attract the Cloud; but, when they meet, the attractive force ceaseth, and then the repulsive power begins; which causeth that flash of Lightning, and consequential noise of Thunder; the Cloud, acting stronger than the Effluvia, darts its electrical or æthereal Fire through the exhalations, &c. to replete them therewith. But if these exhalations, &c. upon their approach to the saturated Cloud, should likewise reach the Earth, then, consequently, the Lightning would dart to the Earth, and might destroy whatever Animals, Vegetables, &c. should happen in its way.

I shall now endeavour further to shew the Similarity of Thunder and Lightning to Electricity. The surprisingly violent shock that is to be given (even in a degree greater than they can well bear) to any number of persons at once, is sufficient to satisfy us, that the Electricity, passing through a Tree in the same manner, must shock the Fluids thereof as it does the animal body. If we could collect a great deal more Electricity, we might split the Tree, as we burst the vessels in Animals kill'd by Electricity, whose bodies look livid, as when kill'd by Lightning.

Mr. *Watson* communicated the following experiment to me, and shew'd me such a large Glass as I am about to describe; but his was broke. He took the hint from Dr. *Bevis*, who, for the same experiment, made use of a flat Glass gilt on both sides, excepting a margin round (no matter what form). This Glass that was shewn me was blown
very

very thin, in the shape of a cylinder like a confectioner's, and open at top, and gilt both on the inside and outside to within two inches of the top. I cover'd mine (which was about twenty inches high, and ten diameter) with gilt leather, as high as it was gilt; which preserv'd it from breaking, and made it act the stronger. The metal within such a Glass as I have described, when electrified, will act with greater vigour more than 25000 times its own weight of iron File-dust in bottles electrified; which proves that it is from the number of the points in contact that it comes to act so strongly, and not from the quantity of the metal. I let a piece of Chain hang down from the tube which I had electrified, to electrify the metal within the Glass; I made use of another piece of Chain, about ten yards long, one end of which I laid under the bottom of the Glass, and the other end I held to the tube electrified, to cause the explosion, which was as loud as the report of a Pistol, and the flash of light so very bright as to dazzle the eyes of the beholders; the whole Chain that led the electrical explosion was not only illuminated, but darted Fire in most directions; the report, though as loud as that of a Pistol, was not so short, but more like that of Thunder. The first time I tried this experiment, I thought it had broken the Glass to pieces. In places where the Chain communicated, I have in a proper manner, in one place, put warm Spirits of Wine, in another File-dust, Vitriol, and Water mixt together, some Oil of Turpentine in a third, and in trying the above experiment, all these different things would take fire together; which is a proof, that Electricity is capable of setting fire to all sulphureous Exhalations or Vapours in the Air; and those combustible Clouds taking fire one after the other,

their

their different explosions cause the successive noise of Thunder.

I must here observe, that Water is as great a conveyer of Electricity as Metal, and consequently may, in the producing of Thunder, have the same effects. Such experiments have been tried by the sides of and across great rivers, and the Water has been found to convey the Electricity for several miles together as well as an Iron Chain, the persons trying the experiment receiving as violent a shock.

To give my opinion in what manner that kind of Thunder, &c. is generated, which proves the most destructive.

I first suppose a Cloud form'd principally from Mineral Exhalations, or from Vapours ascending from Waters, and that it is become saturated with electrical Æther; wherefore, the better to convey my meaning, I term it an Electrified Cloud, it being a non-electric become electrified (as my electrified tin tube, and the chain hanging from it into the glass to electrify the metal therein); and at one end of this Cloud, between it and the earth, a sulphureous one annexed, which I call an electrical Cloud; Sulphur being an originally-electric; the particles of Sulphur not suffering the Electricity to pass through (but all light bodies, whether electrical or not, will be attracted into Air): wherefore these electrical Clouds act in the Air as the cylindrical glasses do in our experiments, preventing the body electrified and the non-electric from touching. Secondly, let us suppose a high hill, whose bowels abound with metallic Veins, &c. and Water continually running down from thence into

a river at the foot thereof ; and that Vapours are ascending from that river, and approach to one end of such an electrified Cloud as is before described : let us suppose also, that the end, where the sulphureous Cloud intercepts, hinders the Vapours of the Water from touching the electrified Cloud ; in that case such an intervention will consequently prevent the explosion thereof. In the same manner the cylindrical Glass acts, by preventing the Electricity from passing through the bottom thereof into the Chain laid under it : and we may reasonably allow, that, at the same time that the Vapours are arising from the Waters, the Exhalations may be attracted from the Metals, &c. and are ascending into Air from the top of the mountain, and very probably from the river even to the top of the hill, either from the Water running down the hill, or from the veins of Metal therein, Exhalations, &c. may be gliding up the hill, in order to join the Exhalations ascending from the top thereof, which would carry on the communication between the bottom of the Vapours arising from the river, and the Exhalations arising from the top of the mountain : but if there was no Exhalation, &c. arising from the declining part of the hill, the veins of Metal, &c. in the earth, or the Water running down the hill, would make the communication good ; even dry Land would convey it, but not with so much strength.

It has been found by experiments, that the large quantities of Water in rivers no-ways hinder the circle from being made good ; for Electricity will always pass the nighest way. The Exhalations, &c. ascending from the top of the hill, and approaching that end of the electrified Cloud, where there is no sulphureous Cloud to prevent their touching,

touching, causes that dreadful explosion called Lightning and Thunder, with all its terrible effects.

The Chain that has one end under the cylindrical Glass, having the other end applied to the Tube electrified, acts as the Exhalation, &c. ascending from the hill and water; the upper Cloud saturated with electrical Æther (as before observed) acting as our Tube electrified, and being disturb'd at its end by the approach of the Exhalation, &c. as our electrified Tube is at the approach of the end of the Chain; for when the attractive force ceaseth, the repelling power begins, and, of consequence, must act stronger from the saturated Cloud, than from the effluvia of the earth ascending to it; so darts the electrical Æther from both ends of the Cloud vehemently (in order to keep up the æquilibrium) into the Exhalations and Vapours which arise from the Mountain and River. For I suppose the sulphureous Cloud no longer capable of preventing the Electricity from breaking through (when it exerts itself) than our Glass in the experiment where the shock is given; this æthereal Fire being led in whatsoever direction those Exhalations, &c. are in, may consequently pass through Trees or Animals, &c. they all being great conveyers of this electrical Æther. This Fire, in its progression through the effluvia, electrifies (if the expression be allow'd) each particle thereof; which causeth those particles to fly asunder, and become Air: but especially the hardest of the effluvia; for Sir *Isaac Newton* takes true and permanent Air to be form'd from the Exhalations raised from the hardest and most compact bodies. And as this æthereal Fire is darted from the electrified Cloud at one end, it passes through

the Exhalations, &c. raised from the top of the hill, and so downwards; and from the other end of the Cloud through the Vapours attracted from the water, and so up the hill, in order to saturate all the effluvia with electrical Æther, whose particles, meeting in different directions, repel each other; whereby the particles of the effluvia are made to fly asunder with such astonishing violence, as to rend rocks and trees, burst the vessels of animals, &c.

Metals, and some Minerals (which are great conveyers of Electricity) being generally found in Hills more than elsewhere, I have chosen to suppose a high hill in the foregoing pages on that account; and from an apprehension, that what I have there said may thereby be more easily understood; for the same effects may be produced on level ground.

As to other effects of Electricity similar to those of Thunder and Lightning;

1. The electrical stroke is always strongest where it finds the greatest resistance, and which is always according to the density of the body acted upon. The strong texture of the bones, nerves, and blood-vessels, making the greatest resistance, suffer the most; but it passes more easily through the pores of the Flesh. In like manner, Thunder and Lightning will destroy the Bones, and burst the Vessels of animals, without doing any manifest hurt to their Flesh.

2. When any number of persons join hands, in order to receive the electrical shock, if a stander-by puts his hand upon the shoulder, &c. of any one of
such

such persons when the experiment is tried, it will not have any effect upon such a stander-by; the electrical Fire always taking the highest way: and, from considering the experiment of the large cylindrical Glass, and what more has been said to that purport, it seems probable Thunder and Lightning may happen without any sulphureous matter being set on fire, even so as to have the power to destroy Houses, Trees, Animals, &c. as before observ'd; and being led in the direction of the Exhalation, &c. where two men are, kill one, and spare the other, though they should even touch each other.

3. Electricity will set fire to all inflammatory Exhalations or Vapours (as before observ'd), and they to whatever is combustible; and no doubt but there is always store of sulphureous Exhalations and inflammatory Vapours in the Air, that may take fire at these grand explosions of Lightning and Thunder, which I have been treating of; therefore may set fire to Houses, Trees, Stacks of Hay, Corn, &c. or even melt Metals. The electrical Æther abounding with the subtil parts of terrestrial salts, when led through any matter wherein Metals are contained, may, at the time of Lightning, &c. convey the most powerful of those salts into the pores of such Metal, as it passes through them. And this considered seems to account for that surprising effect of Lightning that has destroy'd a Sword, without hurting the Scabbard that contain'd it. And not unlike to this, in its effects, is *Aqua fortis* (which is drawn from some of the before-mention'd salts), which spares soft bodies, and destroys hard ones.

With me there remains no doubt, that farther proof of the similitude of Electricity to Lightning,
 &c.

Ec. will be often obtained and, clearly manifested from future experiments : and if I shall have the good fortune to have made out satisfactorily what I am firmly persuaded is true, *viz.* that Lightning and Electricity are the same Fire, or to have furnished out hints for others of greater abilities to improve upon, I shall have gained my whole aim, and sit down well pleased with my labour ; having the honour to subscribe myself,

Gentlemen,

Fleetstreet, London,

Dec. 6. O. S.

1748.

Your most devoted

Humble Servant,

B. Rackstrow.

